



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Arjun V. Balasingam	Project Number J0902
Project Title Smart Medicine Cabinet: Using Homemade Sensors, a Microcontroller, and a Laptop to Help Patients Take Medicines on Time	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I invented a medicine cabinet to address a pressing problem our society is facing today. The population of older people in the U.S. is increasing rapidly, and as people grow older they develop memory difficulties. So, older people might forget to take their medications on time, or forget that they have already taken their medications. Consequently, they miss doses of medicines, or take overdoses. To solve this problem I designed and built an electronic system, which can be installed in a medicine cabinet to keep track of a person's intake of medications. The design criteria I followed included (a) low cost, (b) ease of use, (c) reliability, and (d) compatibility with different cabinet types, and medicine bottles.</p> <p>Methods/Materials My invention consists of three subsystems, (1) homemade sensors installed on the cabinet shelves, (2) a microcontroller which repeatedly checks the sensor voltages in a loop, to see if a medicine bottle has been picked up, and (3) a laptop computer which generates visual and audio instructions for the patient based on sensor information gathered by the microcontroller. In this project, I used (1) wood and other supplies, and tools to build the cabinet, (2) some resistors, wires, LEDs, and related electrical tools to build the circuits which were installed on the cabinet shelves, and (3) a microcontroller, a laptop computer and some free software development tools I downloaded from the internet to build the audio-visual user interface. I designed and built the final model, as well as two prototypes using my skills in woodworking, staining, soldering, electrical wiring, and Algebra 1.</p> <p>Results In my final system when a user picks up a bottle from the shelf, a sensor voltage will change from high to low. This is sensed by the microcontroller via its analog pins. The microcontroller then sends this information via a USB cable to the computer. The computer will check, and update a database of medicine dispensing events. Then the computer will issue appropriate audio and visual instructions to the user.</p> <p>Conclusions/Discussion The final version of my system met all of my design criteria. The cost was low because I built inexpensive homemade sensors. My final version as well as the two prototypes were functional, but I used the lessons I learned while making my prototypes to refine the ease of use, and reliability of my final system.</p>	
Summary Statement I invented a Smart Medicine Cabinet which assists people with taking the proper medications, at the proper times; this has the potential to decrease the cost of healthcare.	
Help Received I would like to thank my father, Dr. Pratheep Balasingam, for helpful advice, and Dr. Edgar Berdahl of the CCRMA at Stanford University for insights into interaction design. I would also like to thank my mom for purchasing the necessary materials for this experiment.	